

CLAIMS

1. A computer readable medium encoded with a program that, when executed on a polymer processing apparatus controller, performs a method comprising acts of:

(A) receiving a first input indicative of an amount of a polymeric material to be provided to a polymer processing space of a polymer processing apparatus; and

(B) automatically determining an amount of a blowing agent to be provided to the polymer processing space to form a foamed product based upon the amount of polymeric material.

2. The computer readable medium of claim 1, wherein the act (B) includes an act of automatically determining a plurality of amounts of the blowing agent, each of the plurality of amounts of the blowing agent including a sufficient amount of the blowing agent to form a microcellular foamed product.

3. The computer readable medium of claim 2, further comprising acts of:
(C) displaying the plurality of amounts of the blowing agent on a display device; and
(D) configuring, responsive to a second input selecting one of the plurality of amounts of the blowing agent, a blowing agent delivery system to provide the selected one of the plurality of amounts of the blowing agent to the polymer processing space.

4. The computer readable medium of claim 1, wherein the first input is indicative of the amount of polymeric material to be provided to the polymer processing space when forming a solid product, the method further comprising an act of:

(C) receiving a second input indicative of a desired weight reduction in the solid product;

wherein the act (B) includes an act of automatically determining the amount of the blowing agent to be provided to the polymer processing space to form a microcellular foamed product having the desired weight reduction relative to the solid product.

5. The computer readable medium of claim 4, further comprising an act of:

(D) determining a new amount of the polymeric material to be provided to the polymer processing space to form the microcellular foamed product having the desired weight reduction relative to the solid product.

6. The computer readable medium of claim 5, further comprising an act of:
(E) configuring a blowing agent delivery system to provide the amount of the blowing agent to the polymer processing space to form the microcellular foamed product having the desired weight reduction relative to the solid product.

7. The computer readable medium of claim 6, further comprising an act of:
(F) configuring the polymer processing apparatus to supply the new amount of the polymeric material to the polymer processing space.

8. The computer readable medium of claim 4, further comprising an act of:
(D) configuring a blowing agent delivery system to provide the amount of the blowing agent to the polymer processing space to form the microcellular foamed product having the desired weight reduction relative to the solid product.

9. The computer readable medium of claim 1, wherein the first input is indicative of the amount of polymeric material to be provided to the polymer processing space when forming a solid product, and wherein the act (B) includes an act of automatically determining a plurality of amounts of the blowing agent to be provided to the polymer processing space, each of the plurality of amounts of the blowing agent including a sufficient amount of the blowing agent to form a microcellular foamed product, the method further comprising an act of:

(C) displaying, on a display device, the plurality of amounts of the blowing agent along with an indication of a weight reduction in the microcellular foamed product relative to the solid product for each of the plurality of amounts of the blowing agent.

10. The computer readable medium of claim 9, wherein the method further comprises an act of:

(D) configuring, responsive to a second input selecting one of the plurality of amounts of the blowing agent, a blowing agent delivery system to provide the selected one of the plurality of amounts of the blowing agent to the polymer processing space.

11. The computer readable medium of claim 10, further comprising an act of:

(E) determining a new amount of the polymeric material to be provided to the polymer processing space to form the microcellular foamed product based upon the selected one of the plurality of amounts of the blowing agent.

12. The computer readable medium of claim 11, further comprising an act of:

(F) configuring the polymer processing apparatus to supply the new amount of the polymeric material to the polymer processing space.

13. The computer readable medium of claim 1, wherein the first input is indicative of a mass amount of the polymeric material to be provided to the polymer processing space, and wherein the act (B) includes an act of automatically determining the amount of the blowing agent to be provided to the polymer processing space to form a microcellular foamed product based upon the mass amount of the polymeric material.

14. The computer readable medium of claim 13, wherein the method further comprises an act of:

(C) receiving a second input indicative of a type of the blowing agent;

wherein the act (B) includes an act of automatically determining the amount of the blowing agent to be provided to the polymer processing space to form the microcellular foamed product based upon the mass amount of the polymeric material and the type of the blowing agent.

15. The computer readable medium of claim 13, wherein the method further comprises acts of:

(D) receiving a second input indicative of a type of the blowing agent; and

(E) receiving a third input indicative of a type of the polymeric material;

wherein the act (B) includes an act of automatically determining the amount of the blowing agent to be provided to the polymer processing space based upon the mass amount of the polymeric material, the type of the polymeric material, and the type of the blowing agent.

16. The computer readable medium of claim 1, wherein the first input is indicative of a mass amount of the polymeric material in a microcellular foamed product, and wherein the act (B) includes an act of automatically determining the amount of the blowing agent to

be provided to the polymer processing space to form the microcellular foamed product based upon the mass amount of the polymeric material in the microcellular foamed product.

17. The computer readable medium of claim 16, wherein the method further
5 comprises an act of:

(C) receiving a second input indicative of a type of the blowing agent;

wherein the act (B) includes an act of automatically determining the amount of the
blowing agent to be provided to the polymer processing space based upon the mass amount
of the polymeric material in the microcellular foamed product and the type of the blowing
10 agent.

18. The computer readable medium of claim 16, wherein the method further
comprises acts of:

(D) receiving a second input indicative of a type of the blowing agent; and

15 (E) receiving a third input indicative of a type of the polymeric material;

wherein the act (B) includes an act of automatically determining the amount of the
blowing agent to be provided to the polymer processing space based upon the mass amount
of the polymeric material in the microcellular foamed product, the type of the polymeric
material, and the type of the blowing agent.
20

19. The computer readable medium of claim 1, wherein the first input is indicative
of a volume amount of the polymeric material to be provided to the polymer processing
space, the method further comprising an act of:

(C) receiving a second input indicative of a type of the polymeric material;

25 wherein the act (B) includes an act of automatically determining the amount of the
blowing agent to be provided to the polymer processing space to form a microcellular foamed
product based upon a mass amount of the polymeric material to be provided to the polymer
processing space; and

wherein the mass amount of the polymeric material is determined based upon the type
30 of the polymeric material, a material melt density of the type of the polymeric material, and
the volume amount of the polymeric material.

20. The computer readable medium of claim 19, wherein the method further
comprises an act of:

(D) receiving a third input indicative of a type of the blowing agent;

wherein the act (B) includes an act of automatically determining the amount of the blowing agent to be provided to the polymer processing space to form the microcellular foamed product based upon the mass amount of the polymeric material to be provided to the polymer processing space and the type of the blowing agent.

21. The computer readable medium of claim 1, wherein:

the first input is indicative of a volume amount of the polymeric material to be provided to the polymer processing space;

wherein the act (B) includes an act of automatically determining the amount of the blowing agent to be provided to the polymer processing space to form a microcellular foamed product based upon a mass amount of the polymeric material to be provided to the polymer processing space; and

wherein the mass amount of the polymeric material is determined based upon a material melt density of the polymeric material, and the volume amount of the polymeric material.

22. The computer readable medium of claim 21, wherein the method further comprises an act of:

(C) receiving a second input indicative of a mass percentage of the blowing agent to be provided to the polymer processing space relative to the mass amount of the polymeric material to be provided to the polymer processing space; and

wherein the act (B) includes an act of automatically determining the amount of the blowing agent to be provided to the polymer processing space to form the microcellular foamed product based upon the mass amount of the polymeric material and the mass percentage of the blowing agent.

23. The computer readable medium of claim 22, wherein the method further comprises an act of:

(D) configuring a blowing agent delivery system to provide the amount of the blowing agent to the polymer processing space.

24. The computer readable medium of claim 23, wherein the blowing agent delivery system includes at least one valve through which the blowing agent is provided to the polymer processing space;

wherein the blowing agent delivery system provides a predetermined flow rate of the blowing agent to the at least one valve; and

wherein the act (D) includes an act of determining an open time of the at least one valve based upon the amount of the blowing agent to be provided to the polymer processing space and the predetermined flow rate.

25. The computer readable medium of claim 24, wherein the act (D) further includes an act of controlling the at least one valve according to the open time.

26. The computer readable medium of claim 23, wherein the blowing agent delivery system includes at least one valve through which the blowing agent is provided to the polymer processing space;

wherein the blowing agent delivery system provides a predetermined flow rate of the blowing agent to the at least one valve; and

wherein the act (D) includes an act of determining a position to which the at least one valve is opened based upon the amount of the blowing agent to be provided to the polymer processing space and the predetermined flow rate.

27. The computer readable medium of claim 23, wherein:

the polymer processing apparatus is an injection molding machine that includes a screw having a screw recovery time;

the blowing agent delivery system includes at least one valve; and

the act (D) includes an act of setting a flow rate of the blowing agent delivery system based upon the amount of blowing agent to be provided to the polymer processing space and the screw recovery time.

28. The computer readable medium of claim 23, wherein the blowing agent delivery system includes at least one valve having a valve open time during which the blowing agent flows through the at least one valve and into the polymer processing space, the method further comprising an act of:

(E) receiving a third input indicative of the valve open time;

wherein the act (D) includes an act of setting a flow rate of the blowing agent delivery system based upon the amount of blowing agent to be provided to the polymer processing space and the valve open time.

5 29. The computer readable medium of claim 28, wherein the method further comprises acts of:

 (F) receiving a fourth input indicative of a valve opening condition of the at least one valve; and

 (G) controlling an opening of the at least one valve based upon the valve opening
10 condition.

 30. The computer readable medium of claim 28, wherein the polymer processing apparatus is one of an injection molding machine, a blow molding machine, and an extruder.

15 31. The computer readable medium of claim 28, further comprising an act of:

 (F) monitoring an actual flow rate of the blowing agent that is provided to the polymer processing space by the blowing agent delivery system.

 32. The computer readable medium of claim 28, further comprising an act of:

20 (F) receiving a fourth input indicative of an actual melt pressure of the polymeric material within the polymer processing space;

 wherein the act (D) includes an act of setting a pressure of the blowing agent to be provided to the polymer processing space by the blowing agent delivery system approximately 50-100 psi above the actual melt pressure of the polymeric material.

25 33. The computer readable medium of claim 28, further comprising an act of:

 (F) receiving a fourth input indicative of a desired melt pressure of the polymeric material within the polymer processing space;

 wherein the act (D) includes an act of setting a pressure of the blowing agent to be
30 provided to the polymer processing space by the blowing agent delivery system approximately 50-100 psi above the desired melt pressure of the polymeric material.

 34. The computer readable medium of claim 33, further comprising an act of:

09826503 04501
T09040 E092860

(G) monitoring an actual pressure of the polymeric material within the polymer processing space.

35. The computer readable medium of claim 34, further comprising an act of:

5 (H) monitoring an actual pressure of the blowing agent that is provided to the polymer processing space by the blowing agent delivery system.

36. The computer readable medium of claim 35, further comprising an act of:

10 (I) providing an indication to a user of the polymer processing apparatus when one of the actual pressure of the polymeric material within the polymer processing space is not approximately equal to the desired melt pressure; and

the actual pressure of the blowing agent is more than approximately 100 psi above the desired melt pressure of the polymeric material.

15 37. The computer readable medium of claim 28, further comprising an act of:

(F) receiving a fourth input indicative of a desired melt pressure of the polymeric material within the polymer processing space;

20 wherein the act (D) includes an act of setting a pressure of the blowing agent to be provided to the polymer processing space by the blowing agent delivery system to a pressure that maintains a single-phase solution of the polymeric material and the blowing agent within the polymer processing space.

38. The computer readable medium of claim 28, further comprising an act of:

25 (F) receiving a fourth input indicative of an actual melt pressure of the polymeric material within the polymer processing space;

30 wherein the act (D) includes an act of setting a pressure of the blowing agent to be provided to the polymer processing space by the blowing agent delivery system to a pressure that maintains a single-phase solution of the polymeric material and the blowing agent within the polymer processing space.

39. The computer readable medium of claim 1, wherein the first input is indicative of a volume amount of the polymeric material to be provided to the polymer processing space, the method further comprising an act of:

(C) receiving a second input indicative of a mass percentage of the blowing agent to be provided to the polymer processing space relative to a mass amount of the polymeric material to be provided to the polymer processing space; and

wherein the act (B) includes an act of automatically determining the amount of the blowing agent to be provided to the polymer processing space to form the foamed product based upon the volume amount of the polymeric material to be provided to the polymer processing space, a material melt density of the polymeric material, and the mass percentage of the blowing agent.

40. The computer readable medium of claim 39, wherein the method further comprises an act of:

(D) configuring a blowing agent delivery system to provide the amount of the blowing agent to the polymer processing space.

41. The computer readable medium of claim 40, wherein the blowing agent delivery system includes at least one valve through which the blowing agent is provided to the polymer processing space;

wherein the blowing agent delivery system provides a predetermined flow rate of the blowing agent to the at least one valve; and

wherein the act (D) includes an act of determining an open time of the at least one valve based upon the amount of the blowing agent to be provided to the polymer processing space and the predetermined flow rate.

42. The computer readable medium of claim 41, wherein the act (D) further includes an act of controlling the at least one valve according to the open time.

43. The computer readable medium of claim 40, wherein the blowing agent delivery system includes at least one valve through which the blowing agent is provided to the polymer processing space;

wherein the blowing agent delivery system provides a predetermined flow rate of the blowing agent to the at least one valve; and

wherein the act (D) includes an act of determining a position to which the at least one valve is opened based upon the amount of the blowing agent to be provided to the polymer processing space and the predetermined flow rate.

44. The computer readable medium of claim 40, wherein:
the polymer processing apparatus is an injection molding machine that includes a screw having a screw recovery time;
5 the blowing agent delivery system includes at least one valve; and
the act (D) includes an act of setting a flow rate of the blowing agent delivery system based upon the amount of blowing agent to be provided to the polymer processing space and the screw recovery time.

10 45. The computer readable medium of claim 40, wherein the blowing agent delivery system includes at least one valve having a valve open time during which the blowing agent flows through the at least one valve and into the polymer processing space, the method further comprising an act of:

(E) receiving a third input indicative of the valve open time;

15 wherein the act (D) includes an act of setting a flow rate of the blowing agent delivery system based upon the amount of blowing agent to be provided to the polymer processing space and the valve open time.

20 46. The computer readable medium of claim 45, wherein the method further comprises acts of:

(F) receiving a fourth input indicative of a valve opening condition of the at least one valve; and

(G) controlling an opening of the at least one valve based upon the valve opening condition.

25 47. The computer readable medium of claim 45, wherein the polymer processing apparatus is one of an injection molding machine, a blow molding machine, and an extruder.

48. The computer readable medium of claim 39, further comprising an act of:

30 (F) determining whether the amount of the blowing agent automatically determined in act (B) is within a predetermined range of amounts of the blowing agent to form a microcellular foamed product.

49. The computer readable medium of claim 48, further comprising an act of:

(G) providing an indication to a user of the polymer processing apparatus when it is determined in the act (F) that the amount of the blowing agent is not within the predetermined range of amounts of the blowing agent to form the microcellular foamed product.

5 50. The computer readable medium of claim 49, further comprising an act of:

 (H) requesting, responsive to the act (G) a new mass percentage of the blowing agent to be provided to the polymer processing space relative to the mass amount of the polymeric material to be provided to the polymer processing space when it is determined in the act (F) that the amount of the blowing agent is not within the predetermined range of amounts of the
10 blowing agent to form the microcellular foamed product.

 51. The computer readable medium of claim 49, further comprising an act of:

 (H) configuring a blowing agent delivery system to provide the amount of the blowing agent automatically determined in act (B) when it is determined in the act (F) that
15 the amount of the blowing agent is not within the predetermined range of amounts of the blowing agent to form the microcellular foamed product.

 52. The computer readable medium of claim 45, further comprising an act of:

 (F) monitoring an actual flow rate of the blowing agent that is provided to the
20 polymer processing space by the blowing agent delivery system.

 53. The computer readable medium of claim 52, further comprising acts of:

 (G) receiving a fourth input indicative of a desired melt pressure of the polymeric material within the polymer processing space; and
25 (H) monitoring an actual pressure of the polymeric material within the polymer processing space.

 54. The computer readable medium of claim 53, further comprising an act of:

 (I) providing an indication to a user of the polymer processing apparatus when the
30 actual pressure of the polymeric material within the polymer processing space is not approximately equal to the desired melt pressure.

 55. The computer readable medium of claim 1, wherein the polymer processing apparatus is one of an injection molding machine, a blow molding machine, and an extruder.

09826503 040504

56. A method comprising acts of:

(A) receiving a first input indicative of an amount of a polymeric material to be provided to a polymer processing space of a polymer processing apparatus; and

5 (B) automatically configuring, based upon the amount of polymeric material to be provided to the polymer processing space, a blowing agent delivery system to provide an amount of blowing agent to the polymer processing space to form a foamed product.

57. The method of claim 56, wherein the first input is indicative of the amount of
10 polymeric material to be provided to the polymer processing space when forming a solid product, the method further comprising an act of:

(C) determining, based upon the amount of polymeric material to be provided to the polymer processing space, a plurality of amounts of the blowing agent to be provided to the polymer processing space, each of the plurality of amounts of the blowing agent including a
15 sufficient amount of the blowing agent to form a microcellular foamed product;

(D) displaying, on a display device, the plurality of amounts of the blowing agent along with an indication of a weight reduction in the microcellular foamed product relative to the solid product for each of the plurality of amounts of the blowing agent; and

(E) receiving a second a second input selecting one of the plurality of amounts of the
20 blowing agent;

wherein the act (B) includes an act of automatically configuring, responsive to the act (E), the blowing agent delivery system to provide the selected one of the plurality of amounts of the blowing agent to the polymer processing space.

58. The method of claim 56, wherein the first input is indicative of a volume
25 amount of the polymeric material to be provided to the polymer processing space to form a microcellular foamed product, the method further comprising an act of:

(C) determining an amount of the blowing agent to be provided to the polymer processing space to form the microcellular foamed product based upon a material melt
30 density of the polymeric material and the volume amount of the polymeric material;

wherein the act (B) includes an act of automatically configuring the blowing agent delivery system to provide the amount of the blowing agent determined in act (C).

59. The method of claim 58, wherein:

09825603.040501
FOUO

the polymer processing apparatus is an injection molding machine that includes a screw having a screw recovery time;

the blowing agent delivery system includes at least one valve; and

the act (B) includes an act of automatically setting a flow rate of the blowing agent delivery system based upon the amount of blowing agent to be provided to the polymer processing space and the screw recovery time.

60. The method of claim 58, wherein the blowing agent delivery system includes at least one valve having a valve open time during which the blowing agent flows through the at least one valve and into the polymer processing space, the method further comprising an act of:

(D) receiving a second input indicative of the valve open time;

wherein the act (B) includes an act of automatically setting a flow rate of the blowing agent delivery system based upon the amount of blowing agent to be provided to the polymer processing space and the valve open time.

61. The method of claim 60, further comprising acts of:

(E) receiving a fourth input indicative of a valve opening condition of the at least one valve; and

(F) automatically controlling an opening of the at least one valve based upon the valve opening condition.

62. The method of claim 60, further comprising an act of:

(E) monitoring an actual flow rate of the blowing agent that is provided to the polymer processing space by the blowing agent delivery system.

63. The method of claim 60, further comprising an act of:

(E) receiving a fourth input indicative of an actual melt pressure of the polymeric material within the polymer processing space;

wherein the act (B) includes an act of automatically setting a pressure of the blowing agent to be provided to the polymer processing space by the blowing agent delivery system approximately 50-100 psi above the actual melt pressure of the polymeric material.

64. The method of claim 60, further comprising an act of:

(E) receiving a fourth input indicative of a desired melt pressure of the polymeric material within the polymer processing space;

wherein the act (B) includes an act of automatically setting a pressure of the blowing agent to be provided to the polymer processing space by the blowing agent delivery system approximately 50-100 psi above the desired melt pressure of the polymeric material.

65. The method of claim 64, further comprising an act of:

(F) monitoring an actual pressure of the polymeric material within the polymer processing space.

66. The method of claim 65, further comprising an act of:

(G) monitoring an actual pressure of the blowing agent that is provided to the polymer processing space by the blowing agent delivery system.

67. The method of claim 66, further comprising an act of:

(H) providing an indication to a user of the polymer processing apparatus when one of the actual pressure of the polymeric material within the polymer processing space is not approximately equal to the desired melt pressure; and the actual pressure of the blowing agent is more than approximately 100 psi above the desired melt pressure of the polymeric material.

68. The method of claim 60, further comprising an act of:

(E) receiving a fourth input indicative of a desired melt pressure of the polymeric material within the polymer processing space;

wherein the act (B) includes an act of automatically setting a pressure of the blowing agent to be provided to the polymer processing space by the blowing agent delivery system to a pressure that maintains a single-phase solution of the polymeric material and the blowing agent within the polymer processing space.

69. The method of claim 60, further comprising an act of:

(E) receiving a fourth input indicative of an actual melt pressure of the polymeric material within the polymer processing space;

wherein the act (B) includes an act of automatically setting a pressure of the blowing agent to be provided to the polymer processing space by the blowing agent delivery system to

a pressure that maintains a single-phase solution of the polymeric material and the blowing agent within the polymer processing space.

70. The method of claim 56, wherein the first input is indicative of a volume
5 amount of the polymeric material to be provided to the polymer processing space, the method further comprises acts of:

(C) receiving a second input indicative of a mass percentage of the blowing agent to be provided to the polymer processing space relative to a mass amount of the polymeric material to be provided to the polymer processing space;

10 (D) determining the mass amount of the polymeric material to be provided to the polymer processing space based upon the volume amount of the polymeric material and a material melt density of the polymeric material; and

(E) determining an amount of the blowing agent to be provided to the polymer processing space to form the foamed product based upon the mass amount of the polymeric material and the mass percentage of the blowing agent;

15 wherein the act (B) includes an act of automatically configuring the blowing agent delivery system to provide the amount of the blowing agent determined in act (E).

71. The method of claim 70, wherein:
20 the polymer processing apparatus is an injection molding machine that includes a screw having a screw recovery time;

the blowing agent delivery system includes at least one valve; and

the act (B) includes an act of automatically setting a flow rate of the blowing agent delivery system based upon the amount of blowing agent to be provided to the polymer
25 processing space and the screw recovery time.

72. The method of claim 70, wherein the blowing agent delivery system includes at least one valve having a valve open time during which the blowing agent flows through the at least one valve and into the polymer processing space, the method further comprising an
30 act of:

(D) receiving a second input indicative of the valve open time;

wherein the act (B) includes an act of automatically setting a flow rate of the blowing agent delivery system based upon the amount of blowing agent to be provided to the polymer processing space and the valve open time.

73. The method of claim 72, further comprising acts of:

(G) receiving a fourth input indicative of a valve opening condition of the at least one valve; and

(H) automatically controlling an opening of the at least one valve based upon the valve opening condition.

74. The method of claim 72, further comprising an act of:

(G) monitoring an actual flow rate of the blowing agent that is provided to the polymer processing space by the blowing agent delivery system.

75. The method of claim 72, further comprising acts of:

(G) receiving a fourth input indicative of a desired melt pressure of the polymeric material within the polymer processing space;

(H) monitoring an actual pressure of the polymeric material within the polymer processing space.

76. A method comprising acts of:

(A) providing an amount of polymeric material to a polymer processing space;

(B) introducing an amount of a blowing agent to the polymer processing space; and

(C) controlling the introduction of the amount of the blowing agent in act (B) to provide a single-phase solution of the polymeric material and the blowing agent within the polymer processing space.

77. The method of claim 76, wherein the act (B) includes an act of injecting the amount of the blowing agent to the polymer processing space, the method further comprising an act of:

(D) monitoring a melt pressure of the polymeric material within the polymer processing space;

wherein the act (C) includes an act of regulating a pressure of the blowing agent that is injected into the polymer processing space to approximately 50-100 psi above the melt pressure of the polymeric material within the polymer processing space.

78. The method of claim 77, further comprising an act of:

(E) providing the single-phase solution of the polymeric material and the blowing agent to a mold.

79. A controller for a blowing agent delivery system, comprising:

5 a first input to receive at least one input signal, the at least one input signal including a first input signal indicative of an amount of a polymeric material to be provided to a polymer processing space of a polymer processing apparatus;

10 a processor, coupled to the first input, that determines, based at least upon the first input signal, an amount of a blowing agent to be provided by the blowing agent delivery system to the polymer processing space to form a foamed product; and

15 a first output, coupled to the processor and the blowing agent delivery system, to provide a first output signal to the blowing agent delivery system that automatically configures the blowing agent delivery system to provide the amount of the blowing agent to the polymer processing space.

80. The controller of claim 79, further comprising:

20 an input device, coupled to the first input and the processor, to receive the at least one input signal and provide the at least one input signal to the processor; and

25 a communication device, coupled to the first output and the processor, to receive the first output signal from the processor and provide the first output signal to the blowing agent delivery system.

81. The controller of claim 80, further comprising:

30 a display device, coupled to the processor;

wherein the at least one input signal includes a first input signal and a second input signal, the first input signal being indicative of the amount of polymeric material to be provided to the polymer processing space when forming a solid product;

wherein the processor, responsive to receipt of the first input signal from the input device,

35 automatically determines a plurality of amounts of the blowing agent to be provided to the polymer processing space, each of the plurality of amounts of the blowing agent including a sufficient amount of the blowing agent to form a microcellular foamed product, and

displays the plurality of amounts of the blowing agent on the display device along with an indication of a weight reduction in the microcellular foamed product relative to the solid product for each of the plurality of amounts of the blowing agent;

and

wherein the processor, responsive to receipt of the second input signal selecting one of the plurality of amounts of the blowing agent, provides the first output signal to the communication device to automatically configure the blowing agent delivery system to provide the selected one of the plurality of amounts of the blowing agent to the polymer processing space.

82. The controller of claim 80, wherein the first input signal is indicative of a volume amount of the polymeric material to be provided to the polymer processing space to form a microcellular foamed product;

wherein the processor, responsive to receipt of the first input signal from the input device,

automatically determines the amount of the blowing agent to be provided by the blowing agent delivery system to the polymer processing space to form the microcellular foamed product based upon a material melt density of the polymeric material and the volume amount of the polymeric material, and

provides the first output signal to the communication device to automatically configure the blowing agent delivery system to provide the amount of the blowing agent to the polymer processing space to form the microcellular foamed product.

83. The controller of claim 82, wherein the polymer processing apparatus is an injection molding machine that includes a screw having a screw recovery time;

wherein the blowing agent delivery system includes at least one valve;

wherein the processor, responsive to receipt of the first input signal from the input device,

automatically determines a mass flow rate of the blowing agent to be provided by the blowing agent delivery system based upon the amount of blowing agent to be provided to the polymer processing space and the screw recovery time, and

provides the first output signal to the communication device to automatically configure the blowing agent delivery system to provide the mass flow rate of the blowing agent automatically determined by the processor.

84. The controller of claim 82, wherein the blowing agent delivery system includes at least one valve having a valve open time during which the blowing agent flows through the at least one valve and into the polymer processing space;

5 wherein the at least one input signal includes a second input signal indicative of the valve open time; and

wherein the processor, responsive to receipt of the second input signal from the input device,

10 automatically determines a mass flow rate of the blowing agent to be provided by the blowing agent delivery system based upon the amount of blowing agent to be provided to the polymer processing space and the valve open time, and

provides the first output signal to the communication device to automatically configure the blowing agent delivery system to provide the mass flow rate of the blowing agent automatically determined by the processor.

15 85. The controller of claim 84, further comprising:

a second output, coupled to the communication device and the blowing agent delivery system, to provide a second output signal;

20 wherein the at least one input signal includes a third input signal indicative of a valve opening condition of the at least one valve; and

wherein the processor, responsive to receipt of the third input signal, provides the second output signal to the communication device to automatically control the opening of the at least one valve based upon the valve opening condition.

25 86. The controller of claim 85, wherein the at least one input signal includes a fourth input signal indicative of a desired melt pressure of the polymeric material within the polymer processing space;

30 wherein the first output signal automatically configures the blowing agent delivery system to provide the amount of the blowing agent to the polymer processing space at a pressure approximately 50-100 psi above the desired melt pressure of the polymeric material.

87. The controller of claim 86, wherein the polymer processing apparatus is an injection molding machine having a screw and a screw back pressure regulator, the controller further comprising:

a third output, coupled to the communication device and the screw back pressure regulator, to provide a third output signal;

wherein the processor, responsive to the fourth input signal, provides the third output signal to the communication device to maintain the polymeric material at the desired melt pressure.

88. The controller of claim 87, further comprising:

a second input, coupled to the communication device, to receive a first pressure signal indicative of an actual melt pressure of the polymeric material within the polymer processing space and provide the first pressure signal to the processor;

a third input, coupled to the communication device, to receive a second pressure signal indicative of an actual pressure of the blowing agent delivered to the polymer processing space and provide the second pressure signal to the processor;

wherein the processor monitors the first and second pressure signals, and provides an indication to a user of the polymer processing apparatus when one of

the actual melt pressure of the polymeric material within the polymer processing space is not approximately equal to the desired melt pressure; and

the actual pressure of the blowing agent is more than approximately 100 psi above the desired melt pressure of the polymeric material.

89. The controller of claim 84, wherein the at least one input signal includes a third input signal indicative of a desired melt pressure of the polymeric material within the polymer processing space;

wherein the first output signal automatically configures the blowing agent delivery system to provide the amount of the blowing agent at a pressure that maintains a single-phase solution of the polymeric material and the blowing agent within the polymer processing space.

90. The controller of claim 84, further comprising:

a second input, coupled to the communication device, to receive a first pressure signal indicative of an actual melt pressure of the polymeric material within the polymer processing space;

wherein the first output signal automatically configures the blowing agent delivery system to provide the amount of the blowing agent to the polymer processing space at a pressure approximately 50-100 psi above the actual melt pressure of the polymeric material.

5 91. The controller of claim 80, wherein the first input signal is indicative of a volume amount of the polymeric material to be provided to the polymer processing space; wherein the at least one input signal includes a second input signal indicative of a mass percentage of the blowing agent to be provided to the polymer processing space relative to a mass amount of the polymeric material to be provided to the polymer processing space;
10 and

wherein the processor, responsive to receipt of the first and second input signals from the input device,

automatically determines the amount the blowing agent to be provided to the polymer processing space to form the foamed product based upon the volume amount of the polymeric material and the mass percentage of the blowing agent, and
15

provides the first output signal to the communication device to automatically configure the blowing agent delivery system to provide the amount of the blowing agent to the polymer processing space to form the foamed product.

20 92. The controller of claim 91, wherein the polymer processing apparatus is an injection molding machine that includes a screw having a screw recovery time; wherein the blowing agent delivery system includes at least one valve; wherein the processor, responsive to receipt of the first and second input signals from the input device,

25 automatically determines a mass flow rate of the blowing agent to be provided by the blowing agent delivery system based upon the amount of blowing agent to be provided to the polymer processing space and the screw recovery time, and

provides the first output signal to the communication device to automatically configure the blowing agent delivery system to provide the mass flow rate of the blowing agent automatically determined by the processor.
30

93. The controller of claim 91, wherein the blowing agent delivery system includes at least one valve having a valve open time during which the blowing agent flows through the at least one valve and into the polymer processing space;

wherein the at least one input signal includes a third input signal indicative of the valve open time; and

wherein the processor, responsive to receipt of the third input signal from the input device,

5 automatically determines a mass flow rate of the blowing agent to be provided by the blowing agent delivery system based upon the amount of blowing agent to be provided to the polymer processing space and the valve open time, and

provides the first output signal to the communication device to automatically configure the blowing agent delivery system to provide the mass flow rate of the blowing agent automatically determined by the processor.

94. The controller of claim 93, further comprising:

a second output, coupled to the communication device and the blowing agent delivery system, to provide a second output signal;

15 wherein the at least one input signal includes a fourth input signal indicative of a valve opening condition of the at least one valve; and

wherein the processor, responsive to receipt of the fourth input signal, provides the second output signal to the communication device to automatically control the opening of the at least one valve based upon the valve opening condition.

95. The controller of claim 94, wherein the at least one input signal includes a fifth input signal indicative of a desired melt pressure of the polymeric material within the polymer processing space;

25 wherein the first output signal automatically configures the blowing agent delivery system to provide the amount of the blowing agent to the polymer processing space at a pressure approximately 50-100 psi above the desired melt pressure of the polymeric material.

96. The controller of claim 95, wherein the polymer processing apparatus is an injection molding machine having a screw and a screw back pressure regulator, the controller further comprising:

30 a third output, coupled to the communication device and the screw back pressure regulator, to provide a third output signal;

0983603 "040501
T05040

wherein the processor, responsive to the fifth input signal, provides the third output signal to the communication device to maintain the polymeric material at the desired melt pressure.

97. The controller of claim 93, further comprising:

a second input, coupled to the communication device, to receive a first pressure signal indicative of an actual melt pressure of the polymeric material within the polymer processing space and provide the first pressure signal to the processor;

a third input, coupled to the communication device, to receive a second pressure signal indicative of an actual pressure of the blowing agent delivered to the polymer processing space and provide the second pressure signal to the processor;

wherein the processor monitors the first and second pressure signals, and provides an indication to a user of the polymer processing apparatus when one of

the actual melt pressure of the polymeric material within the polymer processing space is not approximately equal to the desired melt pressure; and

the actual pressure of the blowing agent is more than approximately 100 psi above the desired melt pressure of the polymeric material.

98. The controller of claim 93, wherein the at least one input signal includes a fourth input signal indicative of a desired melt pressure of the polymeric material within the polymer processing space;

wherein the first output signal automatically configures the blowing agent delivery system to provide the amount of the blowing agent at a pressure that maintains a single-phase solution of the polymeric material and the blowing agent within the polymer processing space.

99. The controller of claim 93, further comprising:

a second input, coupled to the communication device, to receive a first pressure signal indicative of an actual melt pressure of the polymeric material within the polymer processing space;

wherein the first output signal automatically configures the blowing agent delivery system to provide the amount of the blowing agent to the polymer processing space at a pressure approximately 50-100 psi above the actual melt pressure of the polymeric material.